

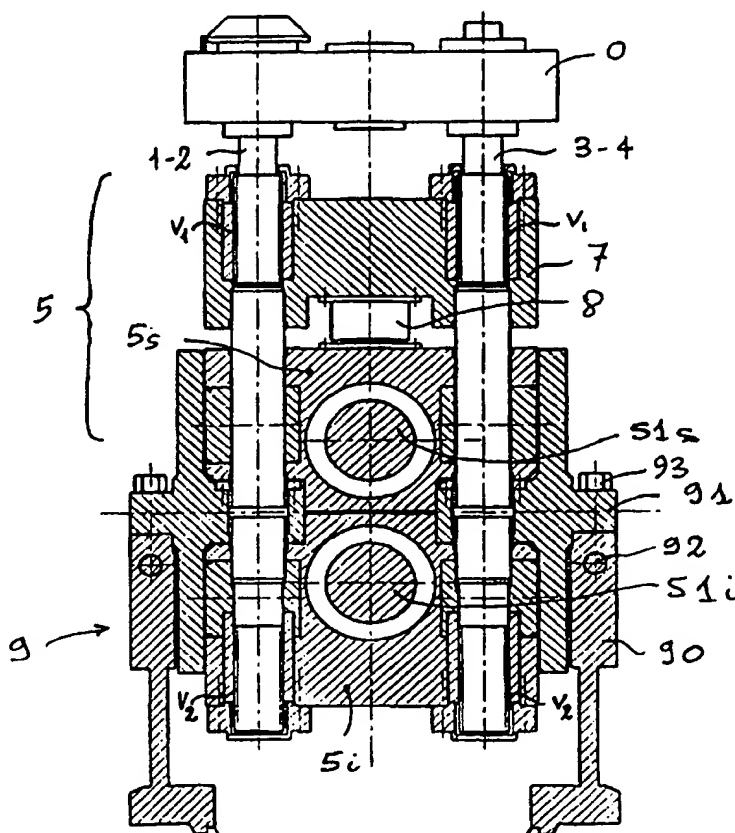
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(21) International Application Number: PCT/IT97/00237 (22) International Filing Date: 2 October 1997 (02.10.97) (30) Priority Data: UD96A000188 7 October 1996 (07.10.96) IT (71) Applicant (for all designated States except US): S.I.M.A.C. S.P.A. [IT/IT]; Via Udine, 91, I-33017 Tarcento (IT). (72) Inventor; and (75) Inventor/Applicant (for US only): OFFOIACH, Renzo [IT/IT]; Via Udine, 91, I-33017 Tarcento (IT). (74) Agent: D'AGOSTINI, Giovanni; D'Agostini Organizzazione, Via G. Giusti, 17, I-33100 Udine (IT).		(81) Designated States: AU, BR, CA, CN, CZ, JP, KR, MX, NO, PL, RO, RU, SG, SK, UA, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	

(54) Title: IMPROVED SERVO-ASSISTED ROLLING STAND

(57) Abstract

Two-high rolling stand, of the type involving the possibility of orthogonally moving the respective cylinders (51s, 51i) respect to the rolling axis and in movement which brings them away and close to one another by means of the sliding of the respective cylinder-holding packings (5s, 5i) along four tie-rods (1, 2, 3, 4) placed at the respective four angles of the stand case (9; 90-91), each threaded with opposite right-hand or left-hand screws (V1, V2) for moving in opposition the cylinder-holding upper packing (5s) and the cylinder-holding lower packing (5i), where it is provided at least: an external bridge part (7) which is engaged by coupling with the respective threadings of said tie-rods (1, 2, 3, 4) and an internal part (5s Fig. 1; 5i Fig. 3; 5s-5i Fig. 4) which makes up the real cylinder-holding packing, which is guided and slides axially along said tie-rods (1, 2, 3, 4) in a corresponding unthreaded part of these same, and in which said external bridge part (7) is connected by engagement to the respective cylinder-holding packing (5s Fig. 1; 5i Fig. 3; 5s-5i Fig. 4) by means of at least one approaching/removing means with fluid-dynamic cylinder (8) able to remove or approach or more or less press said internal part which makes up said cylinder-holding packing respect to said bridge (7) on the base of a determined quantity of fluid let in or let out by said approaching/removing means (8).



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DESCRIPTION

IMPROVED SERVO-ASSISTED ROLLING STAND

This invention has for object a rolling stand with servoassisted adjustment.

In prior art it is known the advantage of adjusting automatically during the rolling process the position of the rolling cylinders to adapt progressively the pass to the needs of progressive reduction of the thickness of the rolled section.

It is known that the rolling products, during their rolling, have a temperature variableness in their length and therefore a yielding variableness (compression strength or pressing strength), what determines different loads on the cylinders, that is different yielding of the structure.

Thus if the tail of a rod is colder than the head, during the rolling, the thickness of the rolled section tends to be higher on the tail because of a slight yielding of the cylinders which under a higher stress are more spaced (presence of unavoidable slacks and higher bending stress), or vice-versa in warmer areas of the rolled section.

In a word the presence of different temperatures (example between head and tail) causes the problem of the traditional stands of obtaining products not homogeneous in their size because of the different rolling loads deriving from the uneven temperature.

All this brings to the impossibility of obtaining rolled products with lower tolerances with the traditional rolling stands, particularly for the rolling of long products.

The servoassisted adjustment of the rolling cylinders is traditionally adopted for the large products rolling, that is sheet plates, bands and

1 large flats and this is carried out by using a quarter-stand involving two
2 upper hydraulic jacks which press on the upper cylinder so to adjust it
3 automatically in lowering and lifting.

4 Thus by suitable servocontrols of the prior art it is possible to
5 automatically adjust the pass thickness during the rolling phase.

6 The same need exists presently in the hot rolling of long products (wire-
7 rod, wire, rod, rod sections, etc....).

8 The existing adjustment art for the rolling of long products is still carried
9 out mechanically by manual screw systems or by electro-controlled
10 reduction gears which anyway need a lot of maintenance.

11 For such reason the applicant himself asked for an application for a
12 servoassisted adjustment stand with an Italian Patent application IT-
13 UD94A000189.

14 This solution proposes the realization of a two-high rolling stand, of the
15 type involving the possibility of moving orthogonally the respective
16 cylinders removing and approaching them from one another by the
17 sliding of the respective cylinder-holding packings along four tie-rods
18 placed at the respective four angles of the stand's plan, where at least at
19 one end of each of said tie-rods, is applied an hydraulic jack which,
20 fastened to the end of each of said tie-rods, acts by pressure or by
21 retraction against the respective packing which carries the respective
22 rolling cylinder.

23 This solution even if advantageous involves the problem of moving the
24 whole stand bulk and anyway it is very complex.

25 The purpose of this invention is that of considerably simplifying the
26 self-adjustment system of the distance between the cylinders of the
27 rolling stand, which can be a two-high or a three-high stand, both
28 before and during the rolling so that the cylinders modify their distance

1 according to the variation of the characteristics of the section being
2 rolled.

3 This and other purposes are reached as claimed by the realization of a
4 two-high rolling stand, of the type involving the possibility of moving
5 orthogonally the respective cylinders respect to the rolling axis and
6 approaching and moving away from each other by the sliding of the
7 respective cylinder-holding packings along four tie-rods placed at the
8 respective four angles of the stand's case, each threaded by a right-hand
9 and left-hand screws opposite to one another for moving the upper
10 cylinder-holding packing and the lower cylinder-holding packing in
11 opposition, characterized in that:

12 - at least one of said packings is made up of two parts:

13 • an external bridge part which is tied by coupling to said respective
14 right-hand or left-hand threadings of said tie-rods and

15 • an internal part which makes up the real cylinder-holding packing,
16 which is guided and slides axially along said tie-rods into a corresponding
17 unthreaded part of these same, and in which

18 - said external bridge part is connected and tied to said internal cylinder-
19 holding part by at least one approaching/spacing means with fluid-
20 dynamic cylinder able to move away or approach or either more or less
21 press said internal part which makes up said cylinder-holding packing
22 respect to said bridge on the base of a determined amount of fluid let in or
23 let out by said approaching/spacing means.

24 Thus the rolling problems are solved in a simple and safe way and it is
25 possible to carry out in a precise and reliable way a complete automatic
26 adjustment of the pass depths also during the rolling.

27 This solution differs from the others because the continuous micro-
28 spacing between the rolling cylinders during the rolling phase is not

1 obtained by screw systems but with a fluid-dynamic system by outlet or
2 inlet of a predetermined volume of fluid in said approaching/spacing
3 means.

4 This solution is also much more simple and reliable respect to the
5 previous solution taught by the IT-UD94A000189 of the same applicant,
6 where it was suggested the use of four hydraulic cylinders (jacks)
7 connected, directly to the tie-rods inserted in the packings.

8 Advantageously the four tie-rods are kept in a fixed position by the
9 single rotation by a base or retaining case which supports a retaining
10 and guiding quadrangular semi-case which, besides maintaining in
11 position said tie-rods, contains and guides also the respective cylinders-
12 holding packings.

13 As much advantageously said four tie-rods are controlled rotationally in
14 unison by an upper gear transmission system (preferably with a worm
15 screw transmission driven by a varying-gear motor of known art).

16 The control of the fluid-dynamic cylinders (oil-hydraulic) is obtained as
17 per traditional art by a feeding through servo-valves, safety valves and
18 locking valves. The system pressure is assured by an hydraulic station
19 and by a systems of accumulators.

20 In the station the fluid is conditioned, that is filtered, cooled or heated, by
21 means of a separate circuit.

22 The control of the cylinders position is assured by the linear transducers
23 connected to the movement of the packings and by pressure measurers
24 which are inserted in the same hydraulic jacks.

25 May be provided some small blocks which slide on the stand vertical
26 guides for the axial locking of the rolling cylinders. The system for the
27 fluid inlet to the hydraulic jacks (cylinders) may be adjusted also by
28 optical sensors of the temperature of the advancing rolled section or also

1 by measurers in continuous (for example laser measurers) of the
2 variation of the rolled section, etc. This being neither restricting nor
3 determining for the invention purposes.

4 The advantages obtained by this solution are substantially the following
5 ones:

- 6 -position control (port between the rolling cylinders) during the same
7 rolling.
- 8 - possibility of interventions for corrections in very short time;
- 9 - higher precision in the positioning, that is in setting the calibration;
- 10 - control of the rolling scraps through the control of the hydraulic
11 pressure with no insertion of load cells.
- 12 - possibility of obtaining rolled products with smaller tolerances on the
13 whole rod length also in the presence of different temperatures (example
14 between head and tail) which with traditional stands would cause
15 products not dimensionally homogeneous because of the different rolling
16 loads deriving from the uneven temperature;
- 17 - possibility of automating and controlling the whole rolling mill in real
18 times;
- 19 - simpler and more economical solution;
- 20 - higher compactness in the rolling equipment.

21 These and other advantages will appear from the following description of
22 a preferred simplified embodiment solution relative to the enclosed
23 drawings.

24 Figure 1 is a cross-sectional schematic view on the vertical plan
25 orthogonal respect to the cylinders axis, passing through a couple of tie-
26 rods of a rolling stand with servoassisted adjustment according to this
27 invention.

28 Figure 2 is a front schematic view.

1 Figures 3 and 4 represent schematically other two solutions, respectively
2 the first one spread out flat respect to the solution of Figures 1 and 2 and
3 the second one with the application of the above mentioned device in the
4 specific case for a three-high stand.
5 Of course the solution in Fig. 4 may be applied also to a two-high stand.
6 In the figures, by 9 is shown the case as a containing base of the whole
7 rolling group.
8 The containing base supports a case 91 dismountable, upturnable by
9 screw means 92, 93 which guides vertically the respective cylinder-
10 holding packings, upper 5s and lower one 5i which include the
11 respective rolling cylinders (51s, 51i).
12 The same case 91 holds and guides vertically fixed the four tie-rods (1-2;
13 3-4) which respect to this same may only rotate freely, but not change
14 position.
15 The rotation of the four tie-rods is absolutely alike and driven by a
16 transmission system with geared upper bridge of the known art (0).
17 All the four tie-rods 1,2,3,4 have two threaded sections respectively with
18 right-hand threading (V1) and with left-hand threading (V2) or vice-
19 versa, an upper one and a lower one.
20 According to the invention the upper packing group (5) is split into a
21 real cylinder-holding packing and into an upper bridge which supports
22 it 7 which is moved by said threaded coupling (v) and is connected to the
23 packing by interconnection with said approaching-removing means
24 either of higher or lower pressure with hydraulic jacks (8) which
25 carries out the continuous movement respect to said bridge 7.
26 More in detail for example as it can be seen in figure 1, the lower
27 threading (V2) couples with the lower packing 5i and the upper
28 threading (V1) instead of coupling as in the traditional solutions with the

1 upper packing, couples with an upper bridge 7.

2 The upper packing instead is free to slide along said tie-rods (1-2; 3-4),
3 and is tied to said upper bridge by said claimed approaching/removing
4 means with higher or lower pressure with fluid-dynamic cylinder (8).

5 In such a way, it is possible:

6 - at first to move the lower packing in alignment with the rolling axis
7 and then;

8 - during the rolling to move or more or less to press the upper packing
9 (5s) continuously in function of the necessary rolling standards and
10 then the respective upper rolling cylinder (51s) respect to said lower
11 packing (5i) and respective lower cylinder supported by it (51i), which
12 instead remain fixed.

13 The slight variation of the rolling axis results as having no effects
14 considered the infinitesimal variation of the positions.

15 Anyway there is nothing which prevents from adopting the more
16 complex solution also at the bottom.

17 Fig. 3 represents an alike but upturned solution in which is the lower
18 packing 5i to be split and supported by the lower bridge 7 and moved by
19 the claimed approach/removal means with higher or lower pressure
20 with fluid-dynamic cylinder (8) placed between them, while the upper
21 packing (5s) with respective cylinder (51s) would remain fixed.

22 In the three-high solution of Fig. 4, the intermediate packing 5m and
23 respective intermediate cylinder 51m would remain fixed, while both
24 packings and upper and lower cylinders (5s-51s; 5i-51i) would be moved,
25 both moved in turn by a respective supporting bridge (7) with said
26 approaching/removing means with higher or lower pressure with
27 interconnection fluid-dynamic cylinder (8).

28 Linear transducers (position sensors) (not shown, of the known art)

1 supply data to the control central unit (not shown) for determining the
2 hydraulic delivery line oil to the respective hydraulic jacks which make
3 up said approaching/removing means with higher or lower pressure
4 (generally two jacks one for each side 8 in correspondence of said
5 couples of housings at the height of the supporting shoulders and
6 between each couple of tie-rods 1-2; 3-4) for the wished adjustment.
7 In this way it is possible to adjust in a simple, reliable and safe way the
8 rolling cylinders as wished also during the rolling phase.

9

Claims

1

2 1. Rolling stand of the type involving the possibility of moving
3 orthogonally the respective cylinders (51s, 51i) respect to the rolling axis
4 and in removal or approach one from the other by the sliding of the
5 respective cylinders-holding packings (5s, 5i) along four tie-rods
6 (1,2,3,4) placed at the respective corners of the stand case (9; 90-91), each
7 threaded with right-hand and left-hand opposite screws (V1, V2) for
8 moving in opposition the upper cylinder-holding packing (5s) and the
9 lower cylinder-holding packing (5i), characterized in that:

10 - at least one of said packings (5s/5i) is made up of two parts (5):

11 • an external bridge part (7) which is tied in coupling to said respective
12 threadings with right-hand or left-hand screws (V1 and/or V2) of said
13 tie-rods (1,2,3,4) and

14 • an internal part (5s Fig. 1; 5i Fig. 3; 5s-5i Fig. 4) which makes up the
15 real cylinder-holding packing, which is guided and slides axially along
16 said tie-rods (1,2,3,4) in a corresponding unthreaded part of these same,
17 and in which

18 - said external bridge part (7) is connected by ties to the corresponding
19 internal part as a cylinder-holding packing (5s Fig. 1; 5i Fig. 3; 5s-5i Fig.
20 4) by at least one approaching/removing and/or pressure variation
21 means with fluid-dynamic cylinder (8) able to remove or approach or
22 more or less press said internal part which makes up said cylinder-
23 holding packing (5s Fig. 1; 5i Fig. 3; 5s-5i Fig. 4) respect to said bridge (7)
24 on the base of a determined amount of fluid let in or let out by said means
25 for approaching/removing (8).

26 2. Stand according to claim 1., characterized in that said four tie-rods
27 (1,2,3,4) are kept in a fixed position by allowance of the only rotation by a
28 base or containing base (9, 90) which supports the whole quadrangular

- 1 containing and guiding semi-case (91) which besides keeping in position
2 the four tie-rods (1,2,3,4), contains and guides also the respective
3 cylinders-holding packings (5s, 5i).
- 4 3. Stand according to claim 1., characterized in that said four tie-rods
5 (1,2,3,4) are controlled rotationally in unison by an upper transmission
6 system (0).
- 7 4. Stand according to claim 1., characterized in that the control of said
8 removing/approaching means with or more or less cylinders pressure is
9 carried out by inlet or outlet of a pre-determined amount in volume of
10 fluid according to the standards detected in variation of the rolled section
11 during the rolling process.
- 12 5. Stand according to claim 1., characterized in that the position control
13 of said rolling cylinders (51s, 51i) and respective packings (5s, 5i) and
14 their respective movement, is carried out by reaction to what detected by
15 linear transducers connected to the measuring of the distance and/or
16 movement of the same packings.
- 17 6. Stand according to claim 1., characterized in that the position control
18 of said rolling cylinders (51s, 51i) and respective packings (5s, 5i), is
19 carried out by means of reaction to what detected by pressure measuring
20 means which are inserted in the jacks of said spacing/approaching
21 means with higher or lower pressure (8).
- 22 7. Stand according to claim 1., characterized in that the variation of
23 position in said spacing/approaching means or with higher or lower
24 pressure (8) is carried out by detection of the rolled section standards
25 during the rolling process.
- 26 8. Stand according to claim 1., characterized in that the variation of
27 position in said spacing/approaching means or with higher or lower
28 pressure (8) is carried out by detection of the temperature and/or

1 variation of the temperature constancy in the part of the rolled section
2 during its rolling.
3 9. Stand according to claim 1., characterized in that the variation of
4 position in said spacing/approaching means or with higher or lower
5 pressure (8) is carried out by detection of the size and/or variation of the
6 size constancy of the part of rolled section during its rolling.

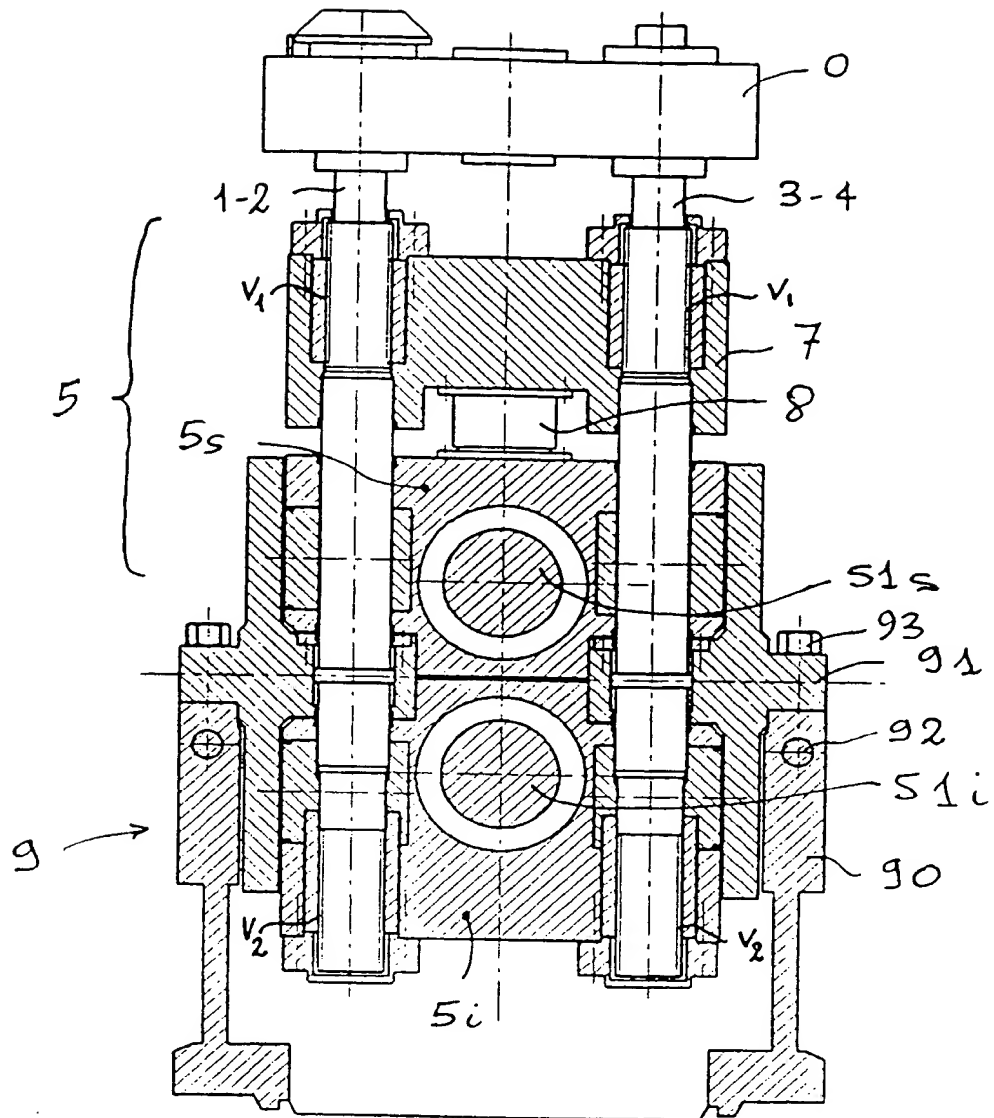
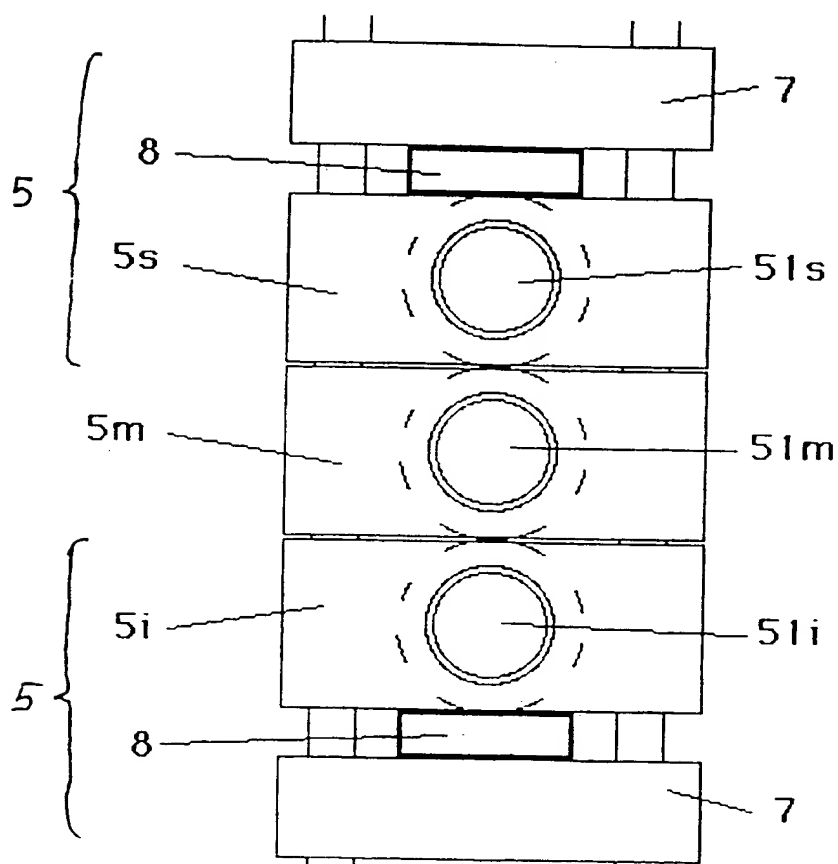
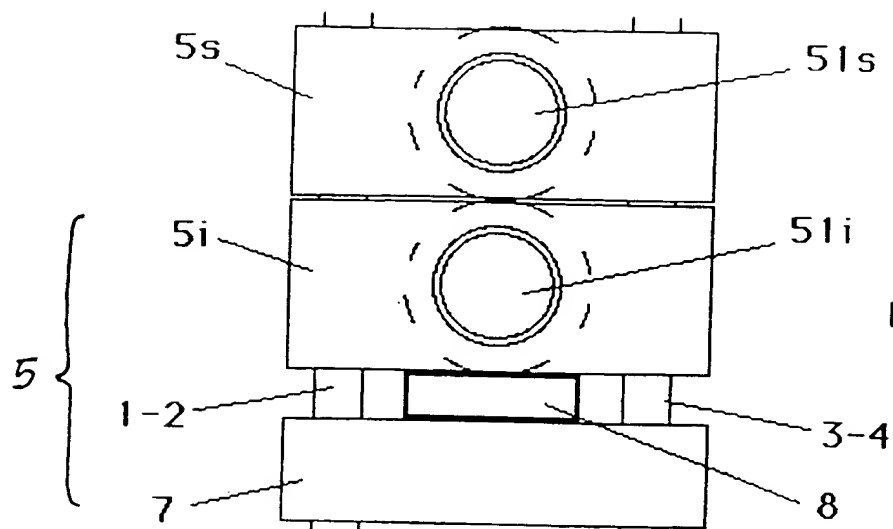


FIG. 1

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INTERNATIONAL SEARCH REPORT

ai Application No

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B21B31/04 B21B37/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DATABASE WPI Section Ch, Week 8933 Derwent Publications Ltd., London, GB: Class M21, AN 89-239703 XP002055784 -& SU 1 458 040 A (KOLPINSK METAL ENGG) , 15 February 1989 see abstract</p> <p style="text-align: center;">---</p>	1-3
A	<p>DATABASE WPI Section Ch, Week 8635 Derwent Publications Ltd., London, GB: Class M21, AN 86-231015 XP002055785 -& SU 1 205 952 A (KOLPINSK VNIIMETMAS) , 23 January 1986 see abstract</p> <p style="text-align: center;">---</p> <p style="text-align: center;">-/--</p>	1,2

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No
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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Initial Application No

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